DATA SHEET

CISCO CATALYST 4500 SERIES SUPERVISOR ENGINE V

High-Density Enterprise LAN Access Supervisor Engine

The Cisco® Catalyst® 4500 Series integrates security and resiliency for advanced control of converged networks (Figure 1).

Figure 1. Cisco Catalyst 4500 Series Supervisor Engine V

OVERVIEW

The Cisco Catalyst 4500 Series Supervisor Engine V continues the nonblocking, robust Layer 2–4 switching found in previous Cisco Catalyst 4500 Series supervisor engines with additional performance, features, and throughput, further enhancing resilient control of converged data, voice, and video networks with high availability to help enable business resiliency for enterprise and metropolitan (metro) Ethernet customers. Network control extends from the backbone to the edge with intelligent services such as granular quality of service (QoS), Internet security, and network management.

The Cisco Catalyst 4500 Supervisor Engine V offers port scalability for resilient Layer 2–4 and routing for both enterprise and service provider market segments. Optimized for the enterprise LAN access, branch-office backbones, or Layer 3 distribution points, the Cisco Catalyst 4500 Series Supervisor Engine V provides the performance and scalability to handle the network applications of today and the future.

The Cisco Catalyst 4500 Series modular architecture provides a “pay-as-you-grow” model, reducing operational expenses and capital expenditures. The Supervisor Engine V is backward-compatible with all current Cisco Catalyst 4500 Series line cards and can be used with the Cisco Catalyst 4503, Catalyst 4506, Catalyst 4507R, and Catalyst 4510R chassis (Table 1).

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Table 1. Comparison Between Supervisor Engine IV, V, and V-10GE

Feature or Description	Supervisor Engine IV	Supervisor Engine V	Supervisor Engine V-10GE
Layer 2–4 Performance	48 Mpps; 64 Gbps	72 Mpps; 96 Gbps	102 Mpps; 136 Gbps
Chassis Support	Cisco Catalyst 4006, Catalyst 4503, Catalyst 4506, and Catalyst 4507R	Cisco Catalyst 4006, Catalyst 4503, Catalyst 4506, Catalyst 4507R, and Catalyst 4510R	Cisco Catalyst 4503, Catalyst 4506, Catalyst 4507R, and Catalyst 4510R
Redundant Capable	Yes (Cisco Catalyst 4507R only)	Yes (Cisco Catalyst 4507R and Catalyst 4510R only)	Yes (Cisco Catalyst 4507R and Catalyst 4510R only)
Active Gigabit Ethernet Uplinks in Redundant Mode	2	4	4
Active 10-Gigabit Ethernet Uplinks in Redundant Mode	0	0	2
Switching Capacity	64 Gbps	96 Gbps	136 Gbps
Throughput	48 Mpps	72 Mpps	102 Mpps
Multilayer Switching	Layer 2–4 services and routing	Layer 2–4 services and routing	Layer 2–4 services and routing
Interior Gateway Routing Protocol (IGRP), Enhanced IGRP (EIGRP), Open Shortest Path First (OSPF), Border Gateway Protocol (BGP), and Intermediate System-to-Intermediate System (IS-IS)	Yes	Yes	Yes
Dynamic Buffer Limiting (DBL): Congestion-Avoidance Feature	Yes	Yes	Yes
QoS Sharing	Support only on nonblocking Gigabit Ethernet ports	Supported on all ports	Supported on all ports
Broadcast Suppression	Software*	Hardware**	Hardware**
Multicast Suppression	No	Yes	Yes
802.1Q-in-802.1Q (QinQ)	Pass-through	In hardware	In hardware
Active Redundant Supervisor-Engine Uplinks	2	4	Two 10-Gigabit Ethernet uplinks or four 1-Gigabit Ethernet uplinks
NetFlow Support	Yes	Yes	Yes (integrated)
Minimum Software Requirement	Cisco IOS 12.1(12c)EW or later	Cisco IOS 12.2(18)EW or later	Cisco IOS 12.2(25)EW or later
CPU	333 MHz	400 MHz	800 MHz
Synchronous Dynamic RAM (SDRAM)	512 MB	512 MB	512 MB
Active VLANs	4000	4000	4000

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Feature or Description	Supervisor Engine IV	Supervisor Engine V	Supervisor Engine V-10GE
Multicast Entries	28,000 (Layer 3); 16,000 (Layer 2)	28,000 (Layer 3); 16,000 (Layer 2)	128,000
STP Instance	3,000	3,000	3,000
Switching Virtual Interfaces (SVIs)	4000	4000	4000
NVRAM	Yes (512 KB)	Yes (512 KB)	Yes (512 KB)
Internet Group Management Protocol (IGMP) Snooping	Yes (16,000)	Yes (16,000)	Yes (16,000)

* Hardware performance for nonblocking Gigabit Ethernet ports, and software performance for all other ports
** Hardware performance for all ports

The Supervisor Engine V can be deployed in single-chassis, nonredundant mode in the Cisco Catalyst 4006, Catalyst 4503, Catalyst 4506, Catalyst 4507R, and Catalyst 4510R; or in redundant mode as an option in the Cisco Catalyst 4507R or Catalyst 4510R chassis (slots 1 and 2 only). (Refer to Table 2.)

Table 2. Cisco Catalyst 4500 Series Supervisor Engine V Performance per Chassis

	Cisco Catalyst 4503 Chassis	Cisco Catalyst 4506 Chassis	Cisco Catalyst 4507R Chassis	Cisco Catalyst 4510R Chassis
Supervisor Engine V (part number WS-X4516)	Supported 28 Gbps and 21 Mpps	Supported 64 Gbps and 48 Mpps	Supported 68 Gbps and 51 Mpps	Supported 96 Gbps and 72 Mpps*

*When Supervisor V is used in the Cisco Catalyst 4510R chassis, slot 10 (flex slot) supports a subset of line cards: 2-port gigabit interface converter (GBIC) [part # WS-X4302-GB] and Access Gateway Module (part number WS-X4604-GWY). Future supervisor engines will allow slot 10 to accommodate any and all line cards.

SUPERVISOR ENGINE V REDUNDANCY FOR BUSINESS RESILIENCY

The Cisco Catalyst 4500 Series was designed to maximize desktop user uptime, with noninterrupted hardware switching. The Cisco Catalyst 4510R and Catalyst 4507R support 1 + 1 supervisor redundancy, using the Supervisor Engine V. The primary supervisor is active and is responsible for normal system operation. The other supervisor serves as a secondary standby, monitoring the operation of the primary supervisor.

With the support of stateful switchover (SSO), information is synchronized between supervisors to allow the standby supervisor to immediately take over in subsecond time when the primary is nonoperational. Layer 2 links are maintained transparently without the need of renegotiating sessions. As a result, business-critical applications such as voice-over-IP (VoIP) calls are not dropped. Nonstop forwarding (NSF) awareness is also supported, providing the ability to interface with Cisco NSF-capable devices and to continue forwarding packets as routing information is updated upon a supervisor-engine switchover.

The redundancy scheme using the Supervisor Engine V is similar to that of the Supervisor Engine IV. Alerts are generated to the network-monitoring software if either supervisor fails, and hot-swapping of supervisors is supported without disrupting system operation. Switchover of supervisors can be forced by software, or by the user with the Simple Network Management Protocol (SNMP). The resiliency features of the Cisco Catalyst 4500 Series prevent network outages that could result in lost business and revenue.

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PREDICTABLE PERFORMANCE AND SCALABILITY

The Cisco Catalyst 4500 Supervisor Engine V delivers a 96-Gbps switching fabric with a 72-Mpps forwarding rate in hardware for Layer 2–4 traffic. Switching performance is independent of the number of route entries or Layer 3 and 4 services enabled. Hardware-based Cisco Express Forwarding routing architecture allows for increased scalability and performance.

The Cisco Catalyst 4500 Series is optimized for multimedia applications with its advanced multicast support. The Supervisor Engine V supports Protocol Independent Multicast (PIM), Source-Specific Multicast (SSM), and Pragmatic General Multicast (PGM) to provide end users with additional scalability to support multimedia applications. Also supported is Internet IGMP snooping in hardware, enhancing performance and reducing network traffic by allowing a switch to dynamically add and remove hosts from a multicast group.

INTELLIGENT NETWORK SERVICES WITH QOS AND SOPHISTICATED TRAFFIC MANAGEMENT

The Cisco Catalyst 4500 Series Supervisor Engine V offers superior per-port QoS features to help ensure that network traffic is classified, prioritized, and scheduled optimally to efficiently handle bandwidth-hungry multimedia, time-sensitive (voice), and mission-critical applications. The Supervisor Engine V can classify, police, and mark incoming packets, allowing the administrator to differentiate between traffic flows and enforce policies. Sharing, shaping, and strict priority configurations determine scheduling of egress traffic. The Supervisor Engine V also supports DBL, a congestion-avoidance feature. For details about the QoS features (including DBL) on the Supervisor Engine V, refer to the QoS on Cisco Catalyst 4500 Series Cisco IOS Software-Based Supervisor Engines overview at:
http://www.cisco.com/en/US/partner/products/hw/switches/ps4324/prod_white_papers_list.html

COMPREHENSIVE MANAGEMENT

The Cisco Catalyst 4500 Series Supervisor Engine V features a single console port and a single IP address to manage all system features. Remote in-band management is available with SNMP, Telnet client, BOOTP, and Trivial File Transfer Protocol (TFTP). Support for local or remote out-of-band management is delivered through a terminal or modem attached to the console interface. The Cisco Smartports Macro is a Cisco Catalyst solution that is also supported, simplifying the configuration of the critical features for the Ethernet networks.

The Cisco Catalyst 4500 Supervisor Engine V delivers a comprehensive set of management tools to provide the required visibility and control in the network. Managed with CiscoWorks solutions, Cisco Catalyst switches can be configured and managed to deliver end-to-end device, VLAN, traffic, and policy management. The CiscoWorks LAN Management Solution (LMS) bundle offers tools such as CiscoWorks Resource Manager Essentials and CiscoView. These Web-based management tools offer several services, including automated inventory collection, software deployment, easy tracking of network changes, views into device availability, and quick isolation of error conditions.

ADVANCED SECURITY

The Cisco Catalyst 4500 Series offers a rich set of industry-leading, integrated security features to proactively lock down your critical network infrastructure. It reduces security risks with 802.1x-based user authentication, authorization, and accounting (AAA). The security policy enforcement is uncompromised with the wire-rate, dedicated access control lists (ACLs) to fend off ever-increasing virus and security attacks. The Cisco Catalyst 4500 Series offers powerful, easy-to-use tools to effectively prevent the untraceable man-in-the-middle attacks, IP spoofing, and flooding attacks, without any change to the end-user or host configurations. Secure remote access and network management is accomplished with the Secure Shell (SSH versions 1 and 2) Protocol and SNMPv3.

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FEATURES AT A GLANCE

Layer 2 Features

- Layer 2 hardware forwarding at 72 Mpps
- Layer 2 switch ports and VLAN trunks
- IEEE 802.1Q VLAN encapsulation
- Inter-Switch Link (ISL) VLAN encapsulation (excluding blocking ports on WS-X4418-GB)
- Dynamic Trunking Protocol (DTP)
- VLAN Trunking Protocol (VTP) and VTP domains
- Support for 4096 VLANs per switch
- Per-VLAN Spanning-Tree Protocol (PVST+) and Per-VLAN Rapid Spanning-Tree Protocol (PVRST)
- Spanning-tree PortFast and PortFast guard
- Spanning-tree UplinkFast and BackboneFast
- 802.1s
- 802.1w
- 802.3ad
- Spanning-tree root guard
- Cisco Discovery Protocol
- IGMP snooping v1, v2, and v3
- Cisco EtherChannel®, Cisco Fast EtherChannel, and Cisco Gigabit EtherChannel technology across line cards
- Port Aggregation Protocol (PAgP)
- Link Aggregation Protocol (LACP)
- Unidirectional link detection (UDLD) and aggressive UDLD
- QinQ in hardware
- Layer 2 protocol tunneling
- Jumbo frames (up to 9216 bytes)
- Baby giants (up to 1600 bytes)
- Unidirectional Ethernet
- SSO in subsecond failover time
- Storm control (formally known as broadcast and multicast suppression)

Layer 3 Features

- Hardware-based IP Cisco Express Forwarding routing at 72 Mpps
- IP routing protocols: EIGRP, OSPF, Routing Information Protocol (RIP), and RIP2
- BGP4 and Multicast Border Gateway Protocol (MBGP)
- NSF awareness
- Hot Standby Router Protocol (HSRP)
- Software routing of Internetwork Packet Exchange (IPX) and AppleTalk
- IS-IS routing protocol
- IGMP v1, v2, and v3
- IGMP filtering on access and trunk ports
- IP Multicast routing protocols (PIM, SSM, and Distance Vector Multicast Routing Protocol [DVMRP])
- PGM

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- Cisco Group Multicast Protocol (CGMP) server
- Full Internet Control Message Protocol (ICMP) support
- ICMP Router Discovery Protocol
- Policy-based routing (PBR)
- Virtual Route Forwarding-lite (VRF-lite)
- IPv6 (software switched)

Sophisticated QoS and Traffic Management

- Per-port QoS configuration
- Support for four queues per port
- Strict priority queuing
- IP differentiated services code point (DSCP)
- Classification and marking based on IP type of service (ToS) or DSCP
- Classification and marking based on full Layer 3 and Layer 4 headers
- Input and output policing based on Layer 3 and Layer 4 headers
- Support for 1024 policers on ingress and 1024 policers on egress configured as aggregate or individual
- Shaping and sharing output queue management
- DBL: Congestion-avoidance feature
- No performance penalty for granular QoS functions
- Auto-QoS command-line interface (CLI) for VoIP deployments

Predictable Performance

- 96-Gbps switching fabric
- Layer 2 hardware forwarding at 72 Mpps
- Layer 3 hardware-based IP Cisco Express Forwarding routing at 72 Mpps
- Layer 4 TCP and User Datagram Protocol (UDP) hardware-based filtering at 72 Mpps
- No performance penalty with advanced Layer 3 and Layer 4 services enabled
- Software-based learning at a sustained rate of 1000 hosts per second
- Support for 32,768 MAC addresses
- Support for 131,072 entries in routing table (shared between unicast and multicast)
- Scalability to 4000 virtual ports (VLAN port instances)
- Bandwidth aggregation up to 16 Gbps through Cisco Gigabit EtherChannel technology
- Hardware-based multicast management
- Hardware-based ACLs

Comprehensive Management

- Single console port and single IP address to manage all system features
- Software configuration management, including local and remote storage
- Optional Compact Flash memory card to store software images for backup and easy software upgrades
- Manageable through CiscoWorks Windows network-management software on a per-port and per-switch basis, providing a common management interface for Cisco routers, switches, and hubs
- SNMP v1, v2, and v3 instrumentation, delivering comprehensive in-band management
- CLI-based management console to provide detailed out-of-band management

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- Remote Monitoring (RMON) software agent to support four RMON groups (history, statistics, alarms, and events) for enhanced traffic management, monitoring, and analysis
- Support for all nine RMON groups through the use of a Cisco SwitchProbe® analyzer (Switched Port Analyzer [SPAN]) port, which permits traffic monitoring of a single port, a group of ports, or the entire switch from a single network analyzer or RMON probe
- Analysis support, including ingress port, egress port, and VLAN SPAN
- NetFlow VLAN statistics (Cisco Catalyst 4500 NetFlow Services Card required)
- Layer 2 traceroute
- Remote SPAN (RSPAN)
- Cisco Smartports Macros
- SPAN ACL filtering
- Dynamic Host Configuration Protocol (DHCP) client autoconfiguration
- Enhanced SNMP MIB support

Advanced Security

- TACACS+ and RADIUS, which enable centralized control of the switch and restrict unauthorized users from altering the configuration
- Standard and extended ACLs on all ports
- 802.1x user authentication (with VLAN assignment, port security, and guest VLAN extensions)
- 802.1x accounting
- Trusted boundary
- Router ACLs (RACLs) on all ports (no performance penalty)
- VLAN ACLs (VACLs)
- Port ACLs (PACLs)
- Private VLANs (PVLANs) on access and trunk ports
- DHCP snooping and Option 82 insertion
- Port security
- Sticky port security
- SSHv1 and SSHv2
- VLAN Management Policy Server (VMPS) client
- Unicast MAC filtering
- Unicast port flood blocking
- Dynamic Address Resolution Protocol (ARP) inspection
- IP source guard
- Community private VLAN

CISCO CATALYST 4500 SERIES NETFLOW SERVICES CARD FOR SUPERVISOR ENGINE V

The Cisco Catalyst 4500 NetFlow Services Card is an optional daughter card for the Cisco Catalyst 4500 Series Supervisor Engine IV or V, providing Layer 3 and 4 statistics and enhanced VLAN statistics without affecting the forwarding performance rates (Figure 2).

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Figure 2. Cisco Catalyst 4500 NetFlow Services Card

NetFlow Services Card Product Description

NetFlow allows customers to monitoring traffic flows for the purpose of billing, network planning, or security. The Cisco Catalyst 4500 NetFlow Services Card supports per-packet, statistics capture in hardware for flow- and VLAN-based statistics monitoring. NetFlow captures and caches detailed information about each data flow (a stream of packets traveling in one direction from one endpoint to another across the network). Data in the NetFlow cache includes information about specific flows, including the IP address, packet and byte count, time stamp, and application port. Data is then exported, collected, and analyzed for numerous purposes such as virus and denial-of-service (DoS) mitigation, and accounting.
More information about NetFlow technology is available at:
http://www.cisco.com/warp/public/cc/pd/iosw/prodlit/iosnf_ds.htm

NetFlow Services Card Applications

NetFlow technology efficiently provides metering for critical applications, including network traffic accounting, usage-based network billing, network planning, network monitoring, and data-mining capabilities for both service provider and enterprise customers.

Enterprise customers have found NetFlow useful for departmental charge-backs, cost allocation, network budget justification, and network monitoring and planning. Service providers are using NetFlow to charge customers according to bandwidth, application usage, QoS, or distance rather than at a flat rate. NetFlow has proven to be a scalable and efficient means of network accounting, capacity planning, and security.

A more detailed list of general NetFlow applications is available at:
http://www.cisco.com/warp/public/732/Tech/nmp/netflow/netflow_techdocs.shtml

NetFlow Services Card Features

NetFlow Data Export Version 5 is supported in Cisco IOS Software Release 12.1(13)EW. Cisco IOS Software Release 12.1(19)EW provides several enhancements, including support for NetFlow Version 8, which support various NetFlow Data Export aggregation schemes. Cisco IOS Software Release 12.1(19)EW also provides additional fields for NetFlow Version 5.

The supported fields within NetFlow Version 5 in Cisco IOS Software Release 12.1(19)EW follow:

- Source and destination IP address (hardware)
- IP Protocol (hardware)
- Layer 4 source and destination ports (for TCP and UDP or 0 otherwise) (hardware)
- Start and end time stamps (hardware)
- Packet counts and byte counts (hardware)
- I/O interface (software)
- Next-hop router (software)
- Source and destination autonomous-system number (software)
- Source and destination prefix mask (software)
- VLAN statistics collection
- CLI support for NetFlow and VLAN statistics

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- SNMP support for VLAN statistics
- NetFlow aggregation support (Version 8)

Cisco Catalyst 4500 NetFlow Services Card Hardware and Software Requirements

The Cisco Catalyst 4500 NetFlow Services Card is supported on the Supervisor Engine IV and V with Cisco IOS Software and is not supported in the Cisco Catalyst Operating System Software.

Software Requirements

The minimum software version for the NetFlow Services Card with Supervisor Engine V is as follows:

- Cisco IOS Software Release 12.2(18)EW or later

Cisco NetFlow Collection Engine (NFC) and Cisco Network Data Analyzer (NDA) requirements:

- Cisco CNS NFC Version 3.5 or higher
- Cisco NDA Version 3.6 or higher

Hardware Requirements

- Supervisor Engine IV or V is required.
- Redundant Supervisor Engine IV or V daughter-card configurations must match. If a Cisco Catalyst 4500 NetFlow Services Card is deployed on a primary supervisor engine, then a second NetFlow Services Card must be deployed on a secondary Supervisor V in the same chassis.

The Cisco Catalyst 4500 NetFlow Services Card can be shipped preinstalled with a Supervisor Engine IV or V from the factory or as a separate, field-replaceable unit. The Supervisor Engine V must be removed from the chassis to install the Cisco Catalyst 4500 NetFlow Services Module; it is not hot-swappable.

TECHNICAL SPECIFICATIONS

Management

- CiscoWorks LMS; includes CiscoWorks Resource Manager Essentials
- Cisco View
- SNMP v1, v2, and v3
- RMON I and II
- RFC 1213-MIB (MIB II)
- UDP-MIB
- TCP-MIB
- CISCO-FLASH-MIB
- CISCO-IMAGE-MIB
- RFC 2233 (IF-MIB)
- CISCO-CONFIG-MAN-MIB
- CISCO-MEMORY-POOL
- CISCO-CDP-MIB
- RMON-MIB lite (RFC 1757)
- RMON2-MIB lite (RFC 2021)
- HC-RMON-MIB
- SMON-MIB

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- ENTITY-MIB (V1-RFC 2037) (V2- RFC 2737)
- CISCO-PROCESS-MIB
- CISCO-CONFIG-COPY-MIB
- CISCO-ENTITY-EXT-MIB
- CISCO-ENTITY-ASSET-MIB
- CISCO-ENTITY-FRU-CONTROL-MIB
- CISCO-ENTITY-SENSOR-MIB
- CISCO-ENVMON-MIB
- BRIDGE-MIB (RFC 1493)
- CISCO-PAGP-MIB
- CISCO-PRIVATE-VLAN-MIB
- CISCO-STP-EXTENSIONS-MIB
- CISCO-VLAN-MEMBERSHIP-MIB
- CISCO-VLAN-IFTABLE-RELATIONSHIP-MIB
- IGMP-MIB
- PIM-MIB
- OSPF-MIB
- CISCO-ENTITY-VENDORTYPE-OID-MIB
- CISCO-SYSLOG-MIB
- BGP4-MIB
- CISCO-BULK-FILE-MIB
- CISCO-CLASS-BASED-QOS-MIB
- CISCO-FTP-CLIENT-MIB
- CISCO-HSRP-MIB
- CISCO-IGMP-FILTER-MIB
- CISCO-IPMROUTE-MIB
- CISCO-PORT-SECURITY-MIB
- CISCO-RMON-CONFIG-MIB
- CISCO-VTP-MIB
- ETHERLIKE-MIB
- EXPRESSION-MIB
- CISCO-PORT-STORM-CONTROL-MIB

Industry Standards

- Ethernet: IEEE 802.3 and 10BASE-T
- Fast Ethernet: IEEE 802.3u, 100BASE-TX, and 100BASE-FX
- Gigabit Ethernet: IEEE 802.3z and 802.3ab
- IEEE 802.3af Power over Ethernet (PoE)
- IEEE 802.1D Spanning Tree Protocol
- IEEE 802.1w rapid reconfiguration of spanning tree
- IEEE 802.1s multiple VLAN instances of spanning tree
- IEEE 802.3ad LACP
- IEEE 802.1p class-of-service (CoS) prioritization
- IEEE 802.1Q VLAN

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- IEEE 802.1x user authentication
- 1000BASE-X (GBIC)
- 1000BASE-X (Small Form-Factor Pluggable [SFP])
- 1000BASE-SX
- 1000BASE-LX/LH
- 1000BASE-ZX
- RMON I and II standards

Supported Line Cards and Modules

- WS-F4531—Cisco Catalyst 4500 NetFlow Services Daughter Card
- WS-X4148-FE-LX-MT—Cisco Catalyst 4500 Fast Ethernet Switching Module, 48-port 100BASE-LX10 single-mode fiber (SMF) (MT-RJ)
- WS-X4148-FE-BD-LC—Cisco Catalyst 4500 Fast Ethernet Switching Module, 48-port 100BASE-BX-D SMF (LC)
- WS-X4124-FX-MT—Cisco Catalyst 4000 Fast Ethernet Switching Module, 24-port 100BASE-FX (MT-RJ)
- WS-X4148-FX-MT—Cisco Catalyst 4500 Fast Ethernet Switching Module, 48-port 100BASE-FX multimode fiber (MMF) (MT-RJ)
- WS-X4124-RJ45—Cisco Catalyst 4500 10/100 Module, 24 ports (RJ-45)
- WS-X4148-RJ—Cisco Catalyst 4500 10/100 Module, 48 ports (RJ-45)
- WS-X4148-RJ21—Cisco Catalyst 4500 10/100 Module, 48-port telco (4 x RJ-21)
- WS-X4248-RJ21V—Cisco Catalyst 4500 PoE 802.3af 10/100, 48 ports(RJ-21)
- WS-X4148-RJ45V—Cisco Catalyst 4500 Cisco Prestandard PoE 10/100, 48 ports (RJ-45)
- WS-X4224-RJ45V—Cisco Catalyst 4500 PoE 803.3af 10/100, 24 ports (RJ-45)
- WS-X4248-RJ45V—Cisco Catalyst 4500 PoE 802.3af 10/100, 48 ports(RJ-45)
- WS-X4232-GB-RJ—Cisco Catalyst 4500 32-Port 10/100 (RJ-45), 2-Gigabit Ethernet (GBIC) Module
- WS-X4232-RJ-XX—Cisco Catalyst 4500 32-Port 10/100 (RJ-45), plus modular uplink slot
- WS-U4504-FX-MT—Cisco Catalyst 4500 Fast Ethernet Uplink Daughter Card for Cisco part number WS-X4232-RJ-XX, 4-port 100BASE-FX (MT-RJ)
- WS-X4302-GB—Cisco Catalyst 4500 Gigabit Ethernet Module, 2 ports (GBIC)
- WS-X4306-GB—Cisco Catalyst 4500 Gigabit Ethernet Module, 6 ports (GBIC)
- WS-X4506-GB-T—Cisco Catalyst 4500 Gigabit Ethernet Module, 6 ports 10/100/1000 802.3af PoE or 1000BASE-X (SFP)
- WS-X4418-GB—Cisco Catalyst 4500 Gigabit Ethernet Module, server switching 18 ports (GBIC)
- WS-X4448-GB-LX—Cisco Catalyst 4500 48-Port 1000BASE-LX (SFPs included)
- WS-X4448-GB-SFP—Cisco Catalyst 4500 Gigabit Ethernet Module, 48 ports 1000BASE-X (optional SFPs)
- WS-X4424-GB-RJ45—Cisco Catalyst 4500 24-Port 10/100/1000 Module (RJ-45)
- WS-X4448-GB-RJ45—Cisco Catalyst 4500 48-Port 10/100/1000 Module (RJ-45)
- WS-X4548-GB-RJ45—Cisco Catalyst 4500 Enhanced 48-Port 10/100/1000 Module (RJ-45)
- WS-X4524-GB-RJ45V—Cisco Catalyst 4500 PoE 802.3af 10/100/1000, 24 ports (RJ-45)
- WS-X4548-GB-RJ45V—Cisco Catalyst 4500 PoE 802.3af 10/100/1000, 48 ports (RJ45)
- WS-G5483—Cisco 1000BASE-T GBIC
- WS-G5484—Cisco 1000BASE-SX Short-Wavelength GBIC (MMF only)
- WS-G5486—Cisco 1000BASE-LX/LH Long-Haul GBIC (SMF or MMF)
- WS-G5487—Cisco 1000BASE-ZX Extended-Reach GBIC (SMF)
- GLC-T—1000BASE-T SFP
- GLC-SC-MM—Gigabit Ethernet SFP, LC connector SX transceiver
- GLC-LH-SM—Gigabit Ethernet SFP, LC connector LX/LH transceiver
- GLC-ZX-SM—1000BASE-ZX SFP

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- Cisco Coarse Wavelength-Division Multiplexing (CWDM) GBIC solution
- Cisco CWDM SFP solution

Indicator and Port Specifications

- System status: Green (operational); red (faulty)
- Switch usage load: 1- to 100-percent aggregate switching usage
- Console: RJ-45 female
- Reset (switch recessed protected)
- Uplinks: Link and active
- Image management port: 10/100BASE-TX (RJ-45 female) data terminal equipment (DTE); green (good); orange (disabled); off (not connected)

Software Requirements

The Cisco Catalyst 4500 Series Supervisor Engine V is supported only in Cisco IOS Software and is not supported in the Cisco Catalyst Operating System Software. The minimum software versions are as follows:

- Supervisor Engine V, Cisco IOS Software Release 12.2(18)EW or later
- Supervisor Engine V with the NetFlow Services Daughter Card, Cisco IOS Software Release 12.2(18)EW

Environmental Conditions

- Operating temperature: 32 to 104ºF (0 to 40ºC)
- Storage temperature: –40 to 167ºF (–40 to 75ºC)
- Relative humidity: 10 to 90 percent, noncondensing
- Operating altitude: –60 to 2000m

Regulatory Standards Compliance

Table 3. Cisco Catalyst Supervisor Engine V Regulatory Standards Compliance

Specification	Standard
Regulatory Compliance	CE marking
Safety	• UL 60950 • CAN/CSA-C22.2 No. 60950 • EN 60950 • IEC 60950 • TS 001 • AS/NZS 3260
EMC	• FCC Part 15 (CFR 47) Class A • ICES-003 Class A • EN55022 Class A • CISPR22 Class A • AS/NZS 3548 Class A • VCCI Class A • ETS 300 386 • EN 55022 • EN 55024 • EN 61000-6-1 • EN 50082-1 • EN 61000-3-2 • EN 61000-3-3
Industry EMC, Safety, and Environmental Standards	• GR-63-Core Network Equipment Building Systems (NEBS) Level 3 • GR-1089-Core Level 3 • ETS 300 019 Storage Class 1.1 • ETS 300 019 Transportation Class 2.3 (pending) • ETS 300 019 Stationary Use Class 3.1 • ETS 300 386

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Table 4 lists ordering information for the Cisco Catalyst 4500 Series Supervisor Engine V.

Table 4. Supervisor Engine V Ordering Information

Product Number	Description
WS-X4516(=)	Cisco Catalyst 4500 Supervisor Engine V, 2 Gigabit Ethernet, console RJ-45
WS-X4516/2	Cisco Catalyst 4500 Redundant Supervisor Engine V, 2 Gigabit Ethernet, console RJ-45
WS-F4531(=)	Cisco Catalyst 4500 NetFlow Services Card
S4KL3-12218EW	Cisco IOS Software: Basic Layer 3 software image (RIP, static routes, IPX, AppleTalk)
S4KL3K91-12218EW	Cisco IOS Software: Basic Layer 3 software image, (RIP, static routes, IPX, AppleTalk, and Triple Digital Encryption Standard [3DES])
S4KL3E-12218EW	Cisco IOS Software: Enhanced Layer 3 software image, (OSPF, EIGRP, and IS-IS)
S4KL3EK91-12218EW	Cisco IOS Software: Enhanced Layer 3 software image, (OSPF, EIGRP, and IS-IS, and 3DES)
MEM-C4K-FLD64M	Cisco Catalyst 4500 Cisco IOS® Software-Based Supervisor, Compact Flash memory, 64-MB option
MEM-C4K-FLD128M	Cisco Catalyst 4500 Cisco IOS® Software-Based Supervisor, Compact Flash memory, 128-MB option

Licensing

Use of BGP4 on the Supervisor Engine V requires a Cisco InterDomain Routing license. A Cisco InterDomain Routing license is required per chassis (Table 5).

Table 5. Cisco Catalyst 4500 Routing License Ordering Information

Product Number	Description
FR-IRC4(=)	Cisco Catalyst Supervisor Engine IV or V InterDomain Routing feature license (BGP4)

WARRANTY

The warranty for the Supervisor Engine V is 90 days and it includes hardware replacement with a 10-day turnaround from receipt of a return materials authorization (RMA).

CISCO TECHNICAL SUPPORT SERVICES—EXTENDING NETWORK INTELLIGENCE THAT PROTECTS YOUR NETWORK INVESTMENT. NOW.

Cisco Technical Support Services help ensure that your Cisco products operate efficiently, remain highly available, and benefit from current system software to assist you in effectively managing your network service while controlling operational costs.

Cisco Technical Support Services provide significant benefits that go beyond what is offered under the Cisco warranty policy. Services available under a Cisco SMARTnet® service contract that are not covered under a warranty include the following (Table 6):

- Latest software updates
- Rapid replacement of hardware in next-day, 4-hour, or 2-hour dispatch options
- Ongoing technical support through Cisco Technical Assistance Center (TAC)
- Registered access to Cisco.com

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Table 6. Technical Support Services—Components

Service Feature Overview	Benefit or Advantage
Software Support	This support offers maintenance and minor and major updates for the licensed feature set. Downloading new maintenance releases, patches, or updates of Cisco IOS Software helps enhance and extend the useful life of Cisco devices. Through major software updates it is possible to extend the life of equipment and maximize application technology investments by: Adding new functions that, in many cases, requires no additional hardware investment Increasing the performance of current functions Enhancing network or application availability, reliability, and stability
Cisco TAC Support	With more than 1000 highly trained customer support engineers, 390 CCIE® experts, and access to 13,000 R&D engineers, Cisco TAC complements your in-house staff with a high level of knowledge in data, voice, and video communications networking technology. Its sophisticated call-routing system quickly routes calls to the correct technology personnel. The Cisco TAC is available 24 hours a day, 365 days a year.
Cisco.com	This award-winning Website provides 24-hour access to an extensive collection of online product and technology information, interactive network management and troubleshooting tools, and knowledge-transfer resources that can help customers reduce costs by increasing staff self-sufficiency and productivity.
Advance Hardware Replacement	Advance Replacement and onsite field engineer options supply fast access to replacement hardware and field resources for installing hardware, minimizing the risk of potential network downtime.

Table 7. Technical Support Services—Competitive Differentiators

Feature	Benefit or Advantage
Worldwide Virtual Lab	This extensive lab of Cisco equipment and Cisco IOS Software versions provides an invaluable engineering resource and knowledge base for training, product information, and recreation and testing of selected network issues to help decrease time to resolution.
Cisco TAC Training **• Boot Camps** **• Tech Calls** **• Tech Forums**	Cisco Systems® is committed to providing customers the latest in technology support. These TAC training programs assist customers in case avoidance as well as provide knowledge transfer of Cisco networking expertise.
Cisco Live	A powerful suite of Internet-enabled tools with firewall-friendly features, these secure, encrypted Java applets can turn a simple phone call into an interactive collaboration session, allowing a customer and Cisco TAC support engineer to work together more effectively.
Global logistics	Award-winning, worldwide hardware replacement support is delivered with 650 depots, covering 120 countries, at a $2.3 billion investment in inventory, taking advantage of 10,000 onsite field engineers.
Cisco IOS Software	This software employs 100 discrete technologies with more than 2000 features. Each year 400 new features are added. Cisco IOS Software is installed in more than 10 million devices and is running on more than 10,000 networks worldwide. It operates on the world's largest IPv6 and VoIP networks and in all major service provider networks worldwide.

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FOR MORE INFORMATION

To learn more about how you can take advantage of Cisco Technical Support Services, talk to your Cisco representative or visit Cisco Technical Support Services at:

http://www.cisco.com/en/US/products/svcs/ps3034/ps2827/serv_group_home.html

For additional information about the Cisco Catalyst 4500, visit:

http://www.cisco.com/go/catalyst4500

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204108.28_ETMG_CC_11.04

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